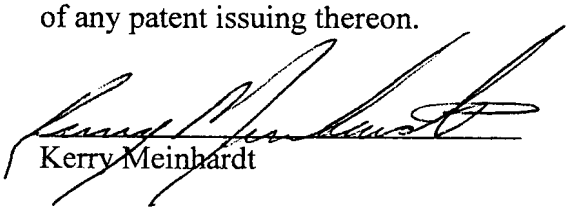
Appl. No.	10/609,069
Applicant	Weil et al.
Filed	06/27/2003
Title	SOLID OXIDE FUEL CELL FRAMES AND METHOD OF MANUFACTURE
TC/A.U.	1745
Examiner	Alix Echelmeyer
Docket No.	12903-B

Mail Stop Non-Fee Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CFR 1.131 Declaration of Kerry Meinhardt

I, Kerry Meinhardt, do hereby declare and state that the invention claimed in the above referenced patent application was conceived and reduced to practice prior to June 24, 2002. The original conception of the invention was recorded on or about November 8, 2000 in the invention report 12903-B attached to this declaration. The inventors, myself included, continued to exercise due diligence in reducing the invention to practice immediately thereafter, and completed the reduction to practice prior to June 24, 2002.

All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. This declaration is made with the understanding that willful false statements and the like are punishable by fine or imprisonment, or both (18 U.S.C. 1001) and my jeopardize the validity of the application of any patent issuing thereon.



Kerry Meinhardt

7/6/06
date

Exhibit A
p1

Battelle . . . Putting Technology To Work

INVENTION REPORT[a]

IPS File No. 12903-B

Title: Low Cost, Metallic Based SOFC Stack Manufacturing Method

ORIGINATOR(S) — WITNESS

Name	Phone	Citizenship	Payroll No.	Org. Code	Center Acronym	Line Manager Name (See Sensitivity Block)[d]
[b] KS Weil	5-6796	U.S.	23K379	D9C78		MT Smith
[b,c] DM Paxton	5-7626	U.S.	3K155	D9C78		MT Smith
[b,c] KD Meinhardt	2-4992	U.S.	3J615	D9C76		LA Chick
[b,c]						
[b,c]						

Name of Witness 1[b]: LA Chick — Name of Witness 2[b]: JW Stevenson

ORIGIN

Date of Conception: 11/7/00 — Date of first Record: 11/7/00

Identify First Record:
- X This Transmittal
- _Lab record book number_____
- _Other – identify in attached description

TEST OF PROOF-OF-PRINCIPLE: Yes ____ No X — Date of Test: ____

If yes, describe in attached test record

__ Drawing(s) -Report -Other attachment

Name of non-inventor to whom technology was first disclosed (can be same as witness): LA Chick

Disclosure was: X oral __written __confidential

FUNDING

SOURCE OF FUNDING FOR CONCEPTION, DOCUMENTATION FOR DEMONSTRATION

1830

__DOE __Other Gov't Agency Related Services

_LDRD __Commercial Work for Others

_CRADA #_____

1831 or Battelle Private

__1831 Contract - Industrial __Gov't

__IR&D

X Private (non-1830, non-1831)

1831 or Battelle Private (contd)

Was 1830 data necessary for conception or test? Yes ___ No X

If yes, was the 1830 data available to the public? Yes ___ No X

If yes, reference #_____

PROVIDE WORK PACKAGE NO.(s). USED FOR CONCEPTION OR TEST. _____ (If non, explain in a separate memo.)

PUBLISHUSE

Do you plan to publish/present? Yes ____ No X

If yes, date _____

PNL/BN # _____ (If cleared)

Journal or Conference (abbreviate) _____

Do you plan to demonstrate the invention to non-Battelle, non-project personnel? Yes X No ____

If yes, date 11/8/00

Will you have a non-disclosure agreement for non-government observers? Yes ____ No ____

Has the invention been used or planned to put into use? Yes X No X Not yet

If yes, date _____

Used by __ Battelle __ Other Entity

Used on __Battelle premises/land -Off-site

SENSITIVITY

LINE MANAGER OR AUTHORIZED DERIVATIVE CLASSIFIER (ADC) SIGNATURE[d]

1. To the best of my knowledge and belief, the attached description ☐ DOES ☒ DOES NOT contain information classified as RESTRICTED DATA, related to national security or to uranium enrichment, or related to storage and disposal of high level nuclear waste or spent fuel, or other sensitive or restricted data (e.g., UCNI, export control).

2. If the technology described in the attached description was generated in a classified or potentially classified subject area, the attached description should be reviewed by an Authorized Derivative Classifier.

☒ Line Manager
☐ ADC

Signature LA Chick Date 11/8/00

a) Two-page form.
b) Fill out the second page of this form.
c) If multiple inventors are named, specify in the attached description the contribution of each inventor. If more than 5 inventors, continue on a separate form. If an inventor is not a permanent Battelle employee, include temporary and permanent home address and phone number on attached description.
d) If multiple Line Managers, only one need sign the sensitivity block, or ADC.

Received IFS
RECEIVED
NOV 10 2000
I.P. SERVICES

Exhibit A
p 2.

(A) Duty of Disclosure Statement (for inventions)

For inventions that may lead to patents, it is a legal requirement that, throughout evaluation and patenting phases, the inventor(s) disclose(s) MATERIAL references (provide copies) that inventor(s) is/are aware of to IP Services.

Examples of MATERIAL information include:

A. Patents and publications which describe one or more features of the inventions or which would appear similar to the invention. Patents and publications can be our own or others. Publications include reports, conference presentations/proceedings, journal articles, newsletters, newspaper articles, brochures and flyers;

B. Information evidencing that the invention, or a closely related invention, was in public use or "on sale" (not necessarily "'sold") by anyone more than one year before the filling date of the U.S. **application;**

C. Information that the invention, or a closely related invention, was made in the United States by someone other than the inventor named in the patent application; and

D. Experimental results, either favorable or unfavorable, involving the invention, particularly any comparisons with the prior art.

Failure to comply fully with this duty may lead to unenforceability of any resulting patent.

You are NOT required to make a search or to certify that no prior art exists **which** is more pertinent than that cited. You are only required to answer to the best of your present knowledge.

It is requested that you **list** in the space provided below those items, if any, **of information** or date presently known to you that you believe may be MATERIAL. to the invention claimed in the above-identified patent application; and that you read carefully the following acknowledgement.

(B) Acknowledgment

I (we) have read and understand the above description of the legally required duty of disclosure. I (we) hereby **affirm** that to the best of my (our) knowledge and belief, I (we) have complied with this duty by disclosing to **Battelle IP** Services as of the date of my (our) signature(s) on Page 1 of this form the following items (identify **all** patents, publications, reports, data, or other documents):

PATENTS: None

(If none, write none. If necessary, attach additional sheet.)

PUBLICATIONS AND REPORTS: None

(If none, write none. **If necessary,** attach additional sheet.)

OTHER INFORMATION OR DATE: _____

(C) General Procedures

Attach a detailed description of the invention to this transmittal sheet; send the originals and 5 copies to the Intellectual Property Services (IPS) Department. The detailed description should specifically define what the inventor(s) regard as the novel concept and, to the extent possible, how the invention is distinguished from known technology. It should include sketches or photographs that would help to understand the **concept,** operative ranges of conditions or constituents, and **advantages** over similar known concepts. Each page of the description, including any drawing(s) or photograph(s) must be signed'and dated by each inventor and two witnesses who have read and understand the invention. If you have questions, please call IP Services 375-2227.

Signatures of Inventors and Witnesses

I am an INVENTOR and have reviewed the information Page 1 of this form and the attached description, and (A) complied with the duty of the disclosure statement, (B) tilled in the **acknowledgment,** and (C) followed the general procedures.

1.	date	2.	date
	11/8/00		11/8/00
3.	date	4.	date	5.	date
	11/8/00				

I have read and understand the **attached** description.

Signature, Witness 1	date	Signature, Witness 2	date
	11/8/00		11/8/00

Exhibit A
P 3

1. Title: "Low-Cost, Metallic-Based SOFC Stack Manufacturing Method"

2. Inventors:

a) KS Weil 3K379
Materials Sciences Department
PSL/422, 375-6796

172 Orchard Way
Richland, WA 99352
628-3524

b) DM Paxton 3K155
Materials Sciences Department
PSL/418, 375-2620

2898 Brighton Court
Kennewick, WA 99338
628-0949

c) KD Meinhardt
Materials Sciences Department
PSL/424, 372-4942

2300 Hood Apt. R
Richland WA 99352
375-3264

3. Description of the Invention

The invention is a low-cost, mass-producible two piece window-frame solid oxide fuel cell (SOFC) design. The SOFC consists essentially of two layers, a metallic separator plate and a metallic spacer/PEN holder plate (into which the PEN structure is glass sealed), which are stacked one upon another in alternating sequence: A/B/A/B/A/etc. The separator is formed from a wrought ferritic stainless steel sheet by shearing. A shearing punch and die is used to punch out the outer dimensions and internal manifold holes of the plate in one step, see Figure 1 (Part B). A similar method is used to stamp out the spacer/PEN holder plate, Figure 1 (Part A). Note that a large hole is punched out of the center of this plate. This is where the ceramic PEN will later be placed. This plate then undergoes a second forming step: closed-die forging (or coining) to form the vertical structure of the manifolds within the cell, as seen in Figure 2. Metal meshes are resistively brazed on either side of the separator plate and the separator is joined to the cathode side of the spacer/PEN bolder by laser welding, forming the cathode cavity. Glass sealing tapes are applied to the zirconia land on the as-fired ceramic PEN and to the flat land on the anode side of the metal subassembly. The PENs are then placed into the metal subassemblies, cathode side down and the filled subassemblies are stacked one

11/8/00 11/8/00 11/8/00
11/8/00 11/8/00

Exhibit A
p 4

upon another to build up the multicell stack assembly. The stack is then fixtured and placed into a furnace for final sealing. A brief assembly methodology is provided below.

Once sealed, the stack is encased within an insulation assembly, as shown in Figure 3. On each of the four side walls of the stack, the insulation consists of a layer of slip cast, dense alumina plate will triangular ridges, forming triangular holes against the side of the stack through which pre-heated air can flow (to heat the stack at start-up). Outboard of the dense alumina is a layer of sub-dense, fibrous alumina board or cloth to act as further thermal insulation. Fibrous alumina board is also used on the top and bottom of the stack for insulation. Outboard of the sub-dense insulation layer is the hot box, fabricated from 304 stainless steel. Four 446 pipes are welded to the four manifolds on the stack to bring fuel and air to and from the stack. Outside of the hotbox, a heavy gauge, multifilament copper cable can be attached to the air inlet pipe (at the top of the stack) and a second cable to the air outlet pipe (at the bottom of the stack) to carry. the electrical current developed by the stack to a DC/AC converter.

Assembly of Coined Cells

Part A: The Spacer/PEN Holder Plate

Material: Sheet stock of doped ferritic stainless steel – 446 type (lmm thick x standard width that minimizes material wastage).

1. Run the sheet through a set of leveling rollers to simultaneously flatten and reduce the thickness to ~ 0.85mm.
2. Simultaneously stamp out the outer dimensions and holes of part A.
3. Close-die forge part A.
4. Surface prep.

Part B: The Separator

Material: Sheet stock of doped ferritic stainless steel – 446 type (lmm thick x standard width that minimizes material wastage).

1. Run the sheet through a set of leveling rollers to simultaneously flatten and reduce the thickness to ~ 0.85mm.
2. Simultaneously stamp out the outer dimensions and holes of part B.
3. Surface prep.

Mesh

Material: Creep-flattened X-750 mesh in long rolls of 2 different thicknesses (to fit inside the anode and cathode cavities).

1. Cut the mesh to size.
2. Coat the cathode mesh with protective coating.

11/8/00 11/8/00 11/8/00 11/8/00 11/8/00

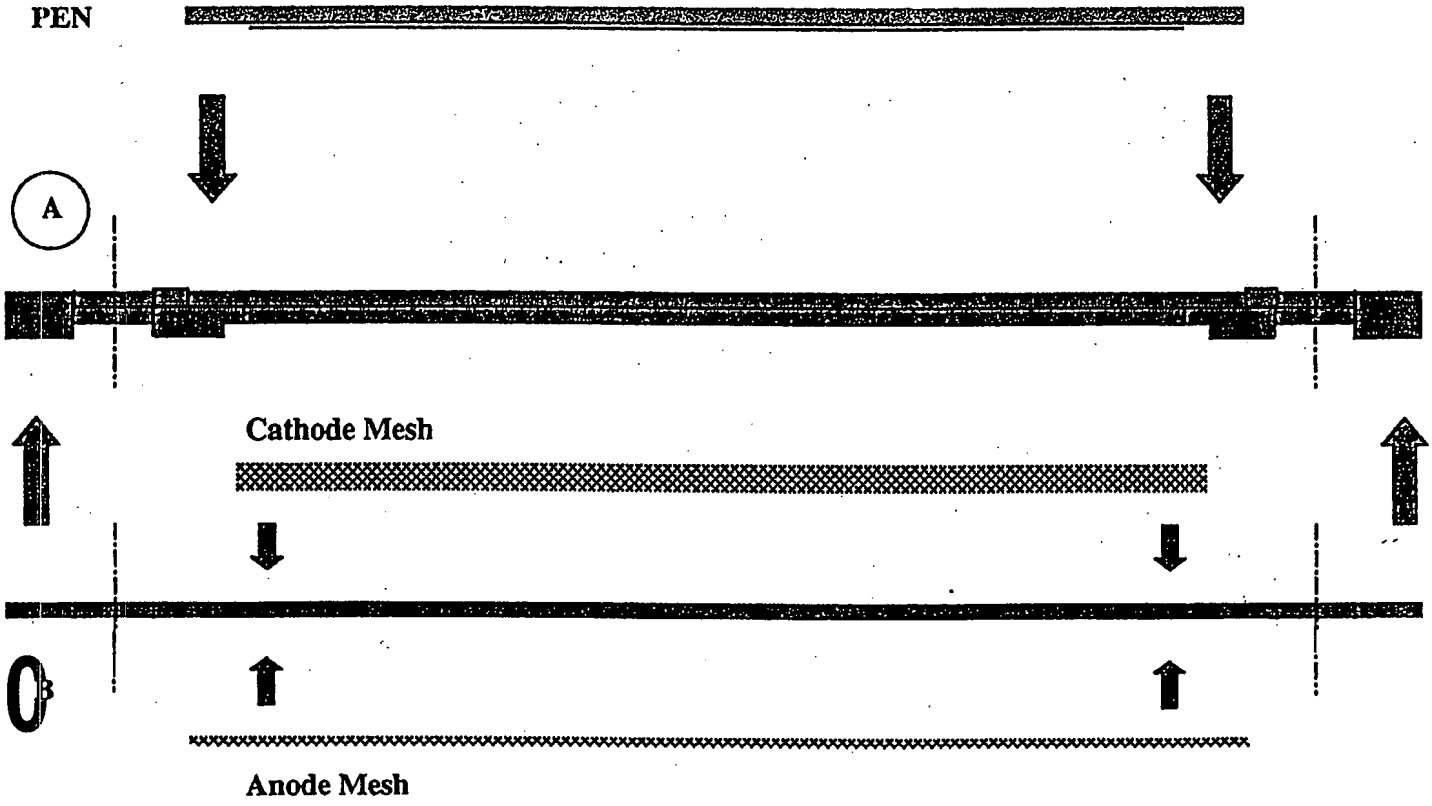
Exhibit A
p 5

Cell and Stack Assembly

1. Resistance braze the meshes to part B.
2. Laser weld part B to the cathode side of part A.
3. Lay up the glass seals on the PEN and on part B.
4. Stack up the parts, fixture, and heat to seal and densify the protective cathode mesh coating.

Option: Roll compacted ferritic stainless powder sheet may be used for part A (which could be easier to "dope", forge, and avoid excessive war-page due to residual stresses, but would require sinter forging or a separate sintering step to densify).

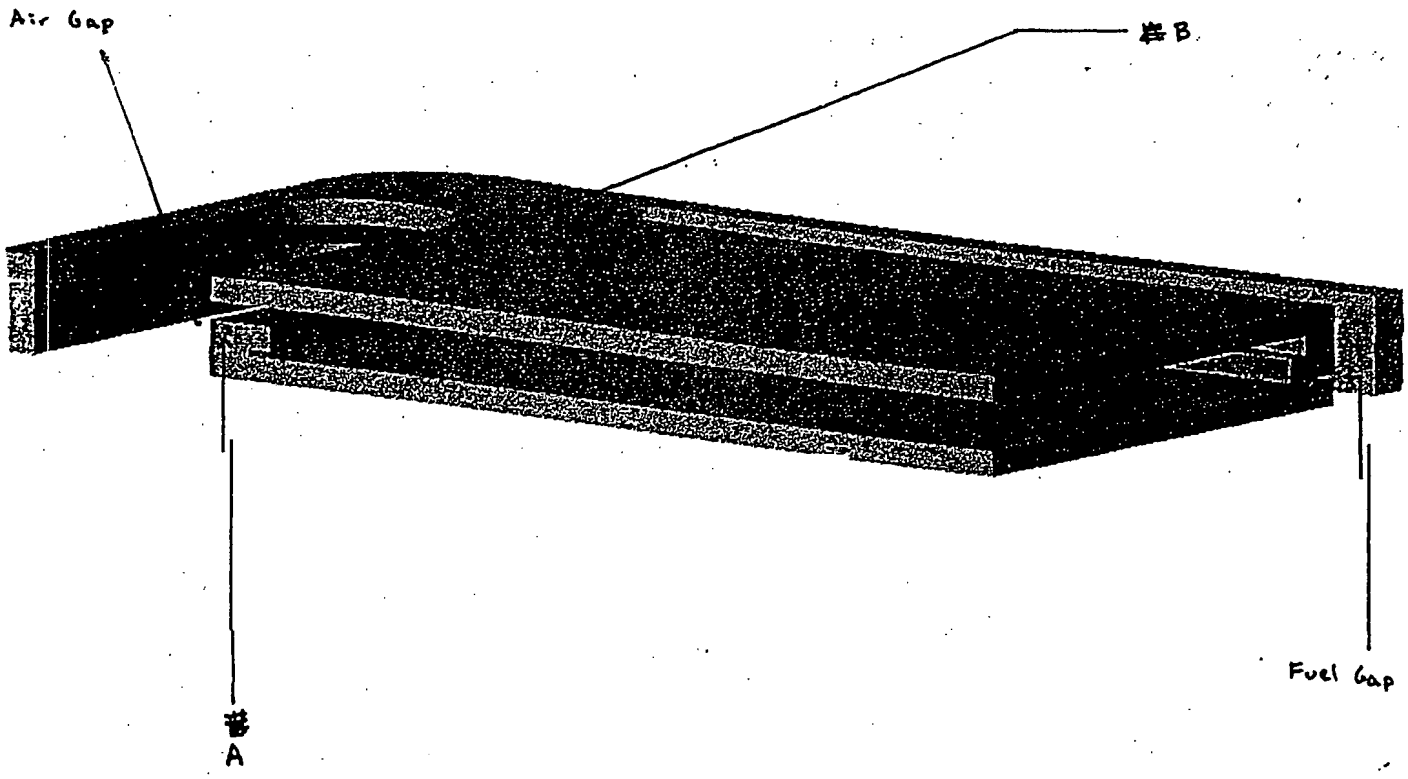
Figure 1: Cross-Section of Coined SOFC Cell



11/8/00 11/8/00 11/8/00 11/8/00

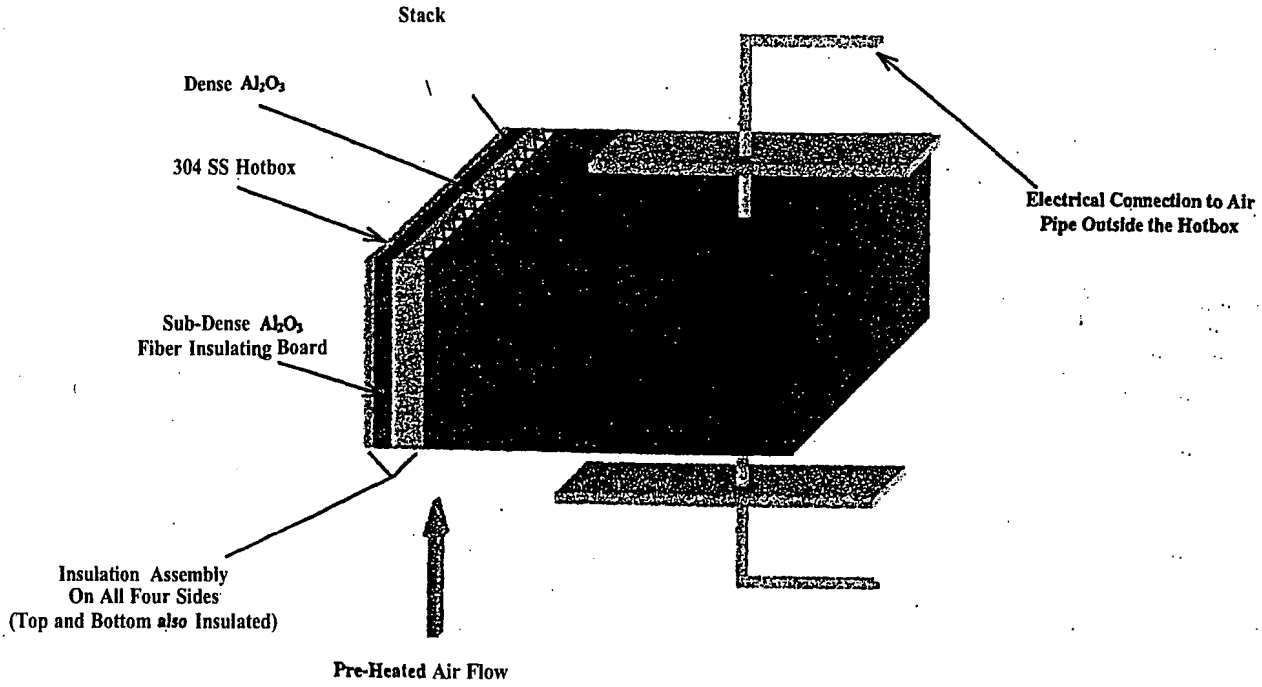
Exhibit A
pg

Figure 2: 3-D Drawing of Coined SOFC Cell



11/8/00
11/8/00
11/8/01
Exhibit A p7

Figure 3: The Insulation and Hotbox Assembly

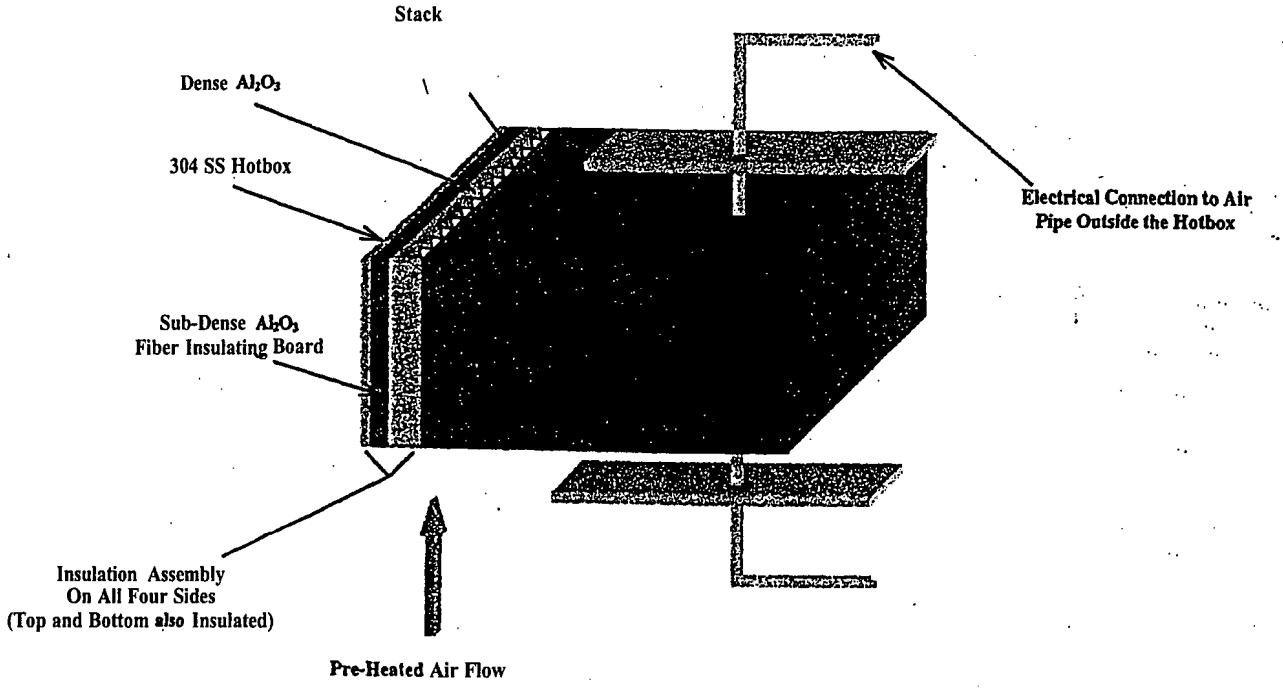


11/8/00 11/8/00 11/8/

11/8/00 11/8/00

Exhibit A p8

Figure 3: The Insulation and Hotbox Assembly



11/8/00 11/8/00 11/8/

11/8/00 11/8/0

Exhibit A
p9